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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/599,622

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Toshiyuki Nagase

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EXAMINER

THOMAS, BRADLEY H

ART UNIT

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/599,622	<b>Applicant(s)</b> NAGASE ET AL.	
	<b>Examiner</b> BRADLEY H. THOMAS	<b>Art Unit</b> 2835	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 03 October 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) 5-14 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4, 15 and 16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 October 2006 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>10/3/2006</u> .   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Restriction Requirement***

1. Acknowledgment is made of Applicant's election of Group I, claims 1-4 and 15-16 with traverse. The claims of Group II (5-14) are withdrawn from consideration.

### ***Drawings***

2. Figure 9 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: in Fig. 9, "42" is not in the specification. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each

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drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Specification***

3. The abstract of the disclosure is objected to because in lines 5-6, it is not clear what "less than 5" is referring to (in regards to units). Correction is required. See MPEP § 608.01(b).
4. Similarly, throughout the specification, Applicant is advised to further clarify quantitatively what "less than 5" represents (e.g. in regards to any applicable units, etc.).

### ***Claim Objections***

5. Claims 1-2 are objected to because of the following informalities: In line 6 of each claim 1 and 2, applicant is advised to further clarify quantitatively what "less than 5" represents, as the current claim language is devoid of any supporting language. Furthermore, regarding claims 1 and 2, Applicant is advised to further clarify what is meant by "a remaining amount". It is not clear what the "remaining amount" is remaining from (i.e. what was the source of the Boron). Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1-2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakuraba et al. (US 6,013,357).

Regarding independent Claim 1, as best understood, Sakuraba et al. teaches a base plate for a power module, comprising:

- a metal plate (not shown, see col. 4, lines 5-14);
- a ceramic base plate (not shown) joined to the metal plate (not shown) (see col. 3, lines 63-66); and
- a release agent (BN) provided in a joint surface between the metal plate (not shown) and the ceramic base plate (not shown) (see col. 4, lines 21-31),

except for explicitly stating:

- wherein a remaining amount of the release agent is less than 5 as an amount of boron measured by fluorescence X-ray analysis, and a crystal grain straining region in the joint surface is equal to or less than 40%.

However, Sakuraba et al. teaches that it is known to use x-ray diffraction to analyze the intensity of remaining boron on the surface of the ceramic substrate (see col. 3, lines 3-30). It would have been obvious to one having ordinary skill in the power module art at the time the invention was made to have kept the remaining amount of boron at a low

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level (e.g. less than 5), since it has been held that discovering an optimum value of a result effective variable (e.g. remaining boron content) involves only routine skill in the art. See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Sakuraba et al. states at col. 4, lines 32-43 that the content of residual boron nitride is a critical factor in providing a high joint strength.

Regarding the crystal grain straining region in the joint surface being equal to or less than 40%, the direct bonding of the ceramic and metal plates would have inherently created a crystal grain straining region in the joint surface. It would have been obvious to one having ordinary skill in the power module art at the time the invention was made to have a crystal grain straining region of 40% or less, since it has been held that discovering an optimum value of a result effective variable (e.g. percentage of crystal grain straining) involves only routine skill in the art. See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Therefore, it would have been obvious to optimize any variable (such as crystal grain) that would improve the reliability of the module, especially in terms of improving the resistance of the module to varying heat cycles (and thereby cracks, etc.) (see col. 7, lines 12-20).

Regarding independent Claim 2, as best understood, Sakuraba et al. teaches a base plate for a power module, comprising:

- a metal plate (not shown, see col. 4, lines 5-14);
- a ceramic base plate (not shown) joined to the metal plate (not shown) (see col. 3, lines 63-66); and

- a release agent (BN) provided in a joint surface between the metal plate (not shown) and the ceramic base plate (not shown) (see col. 4, lines 21-31),

except for explicitly stating:

- wherein a remaining amount of the release agent is less than 5 as an amount of boron measured by fluorescence X-ray analysis, and an amount of crystal grain straining in the joint surface is equal to or less than 0.03%.

However, Sakuraba et al. teaches that it is known to use x-ray diffraction to analyze the intensity of remaining boron on the surface of the ceramic substrate (see col. 3, lines 3-30). It would have been obvious to one having ordinary skill in the power module art at the time the invention was made to have kept the remaining amount of boron at a low level (e.g. less than 5), since it has been held that discovering an optimum value of a result effective variable (e.g. remaining boron content) involves only routine skill in the art. See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Sakuraba et al. states at col. 4, lines 32-43 that the content of residual boron nitride is a critical factor in providing a high joint strength.

Regarding the crystal grain straining having an amount of equal to or less than 0.03%, the direct bonding of the ceramic and metal plates would have inherently created a crystal grain straining region in the joint surface. It would have been obvious to one having ordinary skill in the power module art at the time the invention was made to have a crystal grain straining of equal to or less than 0.03%, since it has been held that discovering an optimum value of a result effective variable (e.g. amount of crystal grain straining) involves only routine skill in the art. See *In re Boesch*, 617 F.2d 272,

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205 USPQ 215 (CCPA 1980). Therefore, it would have been obvious to optimize any variable (such as crystal grain) that would improve the reliability of the module, especially in terms of improving the resistance of the module to varying heat cycles (and thereby cracks, etc.) (see col. 7, lines 12-20).

8. Claims 3-4 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakuraba et al. (US 6,013,357) as applied to claims 1-2 above, and further in view of Furo et al. (US 2002/0164488).

Regarding Claims 3 and 15, Sakuraba et al. teaches:

- the ceramic base plate (not shown) is a plate made of any one of aluminum nitride (see Abstract).

except for:

- the metal plate is made of aluminum.

Sakuraba teaches the metal plate being made of copper. However, Furo et al. teaches a power module and that it is known to use an aluminum metal plate (7) with a ceramic (AlN) plate (see [0007]). It would have been obvious to one having ordinary skill in the power module art at the time the invention was made to have used an aluminum plate as opposed to a copper plate, since Furo et al. states at [0007] that if the metal is aluminum, the evaluation of the thermal cycle may be enhanced remarkably compared with copper, because aluminum is deformable so as to reduce the stress applied to the ceramics.



Furthermore, it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. See *In re Leshin*, 125 USPQ 416. Thus, it would have been obvious to substitute aluminum for copper to take advantages of the properties of aluminum.

Regarding Claims 4 and 16, Sakuraba et al. discloses the claimed invention except for explicitly stating:

- a semiconductor chip mounted on the metal plate of the base plate for a power module.

Furo et al. teaches a power module and that it is known to mount a chip (1) on a metal plate (7) of a power module (see Fig. 1). It would have been obvious to mount a chip on a power module as taught by Furo et al in the device of Sakuraba et al., since the device of Sakuraba et al. is also a power module, and the chips would have allowed for the required current in the power module.

### **Conclusion**

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following references teach power modules: Araki et al. (US 6,485,816), Matsuo et al. (US 2004/0070946) and Nakajima et al. (US 2004/0089928).

The following references teach bonding: Mizunoya et al. (US 4,693,409), Naba (US 5,807,626), Nagase et al. (US 6,033,787), Hirashima et al. (US 2002/0037435), Takeuchi et al. (US 2003/0098632), Takahashi et al. (US 2004/00794951), Hiramatsu et al. (US 2004/0207072) and Nagase et al. (US 2005/0214518).

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRADLEY H. THOMAS whose telephone number is (571)272-9089. The examiner can normally be reached on 7:00am - 3:30pm (Eastern).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jayprakash N. Gandhi can be reached on 571-272-3740. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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